

WHAT IS CLAIMED IS:

Sub A1
1. A method of operating an implantable cardioverter-defibrillator (ICD), the ICD having output means for delivering electrical stimulation of a predetermined polarity, amplitude, shape and duration, the method comprising:

sensing the onset of arrhythmia;

applying biphasic stimulation at a first intensity level selected from the group consisting of at the diastolic depolarization threshold, below the diastolic depolarization threshold or above the diastolic depolarization threshold wherein biphasic stimulation comprises:

a first stimulation phase with a first phase polarity, a first phase amplitude, a first phase shape and a first phase duration; and

a second stimulation phase with a second phase polarity, a second phase amplitude, a second phase shape and a second phase duration; and

determining whether capture has occurred.

2. The method of operating an ICD as in claim 1, wherein it is determined that capture has not occurred, further comprising:

increasing the stimulation intensity level by predefined increments until capture occurs.

3. The method of operating an ICD as in claim 1, wherein it is determined that capture has occurred, further comprising:

continuing biphasic stimulation for a predetermined period of time.

Sub A2
4. The method of operating an ICD as in claim 1, wherein it is determined that capture has occurred, further comprising:

halting biphasic stimulation.

5. The method of operating an ICD as in claim 1 wherein the first phase polarity is positive.

6. The method of operating an ICD as in claim 1 wherein the first phase amplitude is less than the second phase amplitude.

7. The method of operating an ICD as in claim 1 wherein the first phase amplitude is ramped from a baseline value to a second value.

8. The method of operating an ICD as in claim 7 wherein the second value is equal to the second phase amplitude.

9. The method of operating an ICD as in claim 1 wherein the first stimulation phase further comprises a series of stimulating pulses of a predetermined amplitude, polarity and duration.

10. The method of operating an ICD as in claim 9 wherein the first stimulation phase further comprises a series of rest periods.

11. The method of operating an ICD as in claim 10 wherein applying the first stimulation phase further comprises applying a rest period of a baseline amplitude after at least one stimulating pulse.

12. The method of operating an ICD as in claim 11 wherein the rest period is of equal duration to the duration of the stimulating pulse.

13. The method of operating an ICD as in claim 1 wherein the first phase amplitude is at a maximum subthreshold amplitude.

14. The method of operating an ICD as in claim 13 wherein the maximum subthreshold amplitude is about 0.5 to 3.5 volts.

15. The method of operating an ICD as in claim 1 wherein the first phase duration is at least as long as the second phase duration.

16. The method of operating an ICD as in claim 1 wherein the first phase duration is about one to nine milliseconds.

17. The method of operating an ICD as in claim 1 wherein the second phase duration is about 0.2 to 0.9 milliseconds.

18. The method of operating an ICD as in claim 1 wherein the second phase amplitude is about two volts to twenty volts.

19. The method of operating an ICD as in claim 1 wherein the second phase duration is less than 0.3 milliseconds and the second phase amplitude is greater than 20 volts.

20. The method of operating an ICD as in claim 7 wherein the second value is at a maximum subthreshold amplitude.

21. The method of operating an ICD as in claim 20 wherein the maximum subthreshold amplitude is about 0.5 to 3.5 volts.

22. The method of operating an ICD as in claim 7 wherein the first phase duration is at least as long as the second phase duration.

23. The method of operating an ICD as in claim 7 wherein the first phase duration is about one to nine milliseconds.

24. The method of operating an ICD as in claim 7 wherein the second phase duration is about 0.2 to 0.9 milliseconds.

25. The method of operating an ICD as in claim 7 wherein the second phase amplitude is about two volts to twenty volts.

26. The method of operating an ICD as in claim 7 wherein the second phase duration is less than 0.3 milliseconds and the second phase amplitude is greater than 20 volts.

27. The method of operating an ICD as in claim 1 wherein the first stimulation phase is initiated greater than 200 milliseconds after completion of a cardiac beating cycle.

28. A method of operating an implantable cardioverter-defibrillator (ICD), the ICD having output means for delivering electrical stimulation of a predetermined polarity, amplitude, shape and duration, the method comprising:

sensing the onset of arrhythmia;

applying stimulation selected from the group consisting of biphasic stimulation and conventional stimulation at a first intensity level selected from the group consisting of at the diastolic depolarization threshold, below the diastolic depolarization threshold or above the diastolic depolarization threshold;

determining whether capture has occurred;

increasing the stimulation intensity level by predefined increments until capture does occurs; and

upon capture, continuing stimulation selected from the group consisting of biphasic stimulation and conventional stimulation at a second intensity level below the diastolic depolarization threshold.

29. A method of operating an implantable cardioverter-defibrillator (ICD), the ICD having output means for delivering electrical stimulation of a predetermined polarity, amplitude, shape and duration, the method comprising:

defining a first stimulation phase with a positive polarity, a first phase amplitude, a first phase shape and a first phase duration, wherein said first phase amplitude is about 0.5 to 3.5 volts, wherein said first phase duration is about one to nine milliseconds and wherein said first stimulation phase is initiated greater than 200 milliseconds after completion of a cardiac beating cycle;

defining a second phase with a negative polarity, a second phase amplitude, a second phase shape and a second phase duration, wherein said second phase amplitude is about four volts to twenty volts and wherein said second phase duration is about 0.2 to 0.9 milliseconds; and

sensing the onset of arrhythmia;

applying the first stimulation phase and the second stimulation phase in sequence to the cardiac tissue;

determining whether capture has occurred; and

increasing the stimulation intensity level by predefined increments until capture occurs.

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